STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF UNDERGROUND STORAGE TANKS

~~COMPLIANCE GUIDANCE DOCUMENT 104~~TECHNICAL CHAPTER 3.2~~1~~
AUTOMATIC TANK GAUGING

~~EFFECTIVE DATE: July 29, 1996~~EFFECTIVE DATE: TBD
(~~*DRAFT REVISION DATE: March 4, 2011*~~)
(*DRAFT REVISION DATE: ~~August 22, 2011~~May 17, 2012*)

~~REQUIREMENTS FOR AUTOMATIC TANK GAUGING~~

PURPOSE

The purpose of this ~~guidance document~~ technical chapter is to assist ~~tank owners and operators,~~ service providers~~,~~ and Division of Underground Storage Tanks (Division) staff ~~and the regulated community~~ in understanding the regulatory requirements for the operation, features, release detection, and record keeping requirements for underground storage tank (UST) systems which utilize Automatic Tank Gauging (ATG) for leak detection.

This ~~Guidance Document~~technical chapter contains the current policy of the Division based on the statute and regulations governing the Tennessee Petroleum Underground Storage Tank program~~ and this document supersedes all previously published versions.~~, ~~and may be amended from time to time without advance notice to the regulated community as regulatory amendments or policy changes warrant.~~ ~~The most current version of this guidance document will be posted and available on the Division's website.~~

AUTHORITY

All rules referred to in this ~~CGD~~ technical chapter are contained in Chapter 0400-18-01 ~~1200-1-15~~ and are available on the Division of Underground Storage Tanks website at http://www.tn.gov/sos/rules/1200/1200-01/1200-01-15.20110202.pdf (update link)

Formatted: Highlight
Formatted: Highlight

~~The UST Board is currently revising its rules to renumber them following chapters assigned to the Department of Environment and Conservation. The new chapter will be 0400-18-01 when the renumbering is adopted and a link to the renumbered chapter will be on the Division's website referenced above.~~

APPLICABILITY

This document provides technical and specific industry knowledge regarding the operation, maintenance, and release detection requirements for UST systems equipped with ATG systems. The document also provides recommended practices for inspection, discussion of common

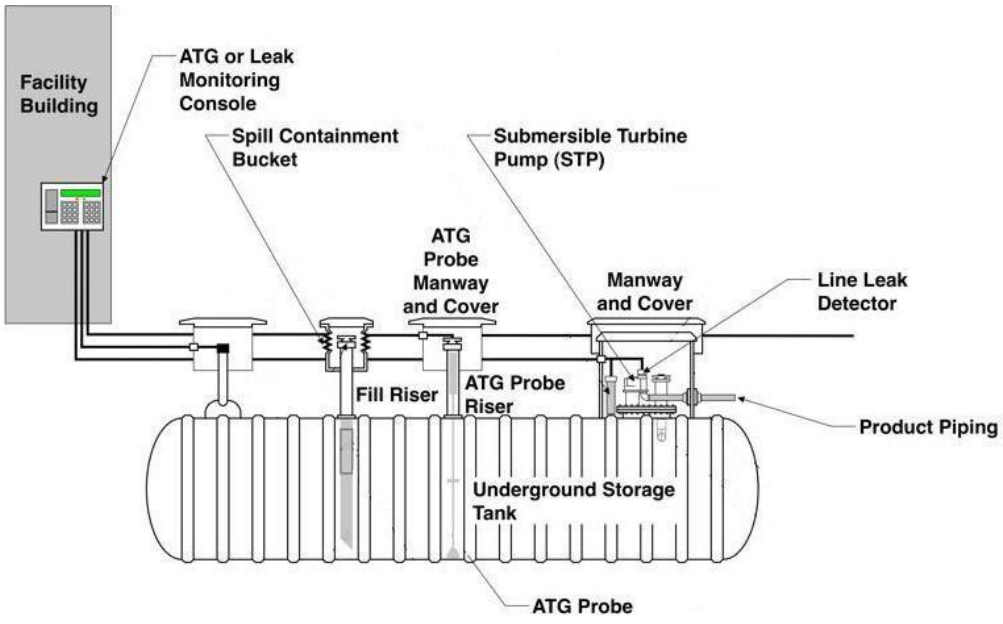
problems associated with ATG systems, and a discussion of the most common types of ATG systems utilized at UST facilities.

Each ATG system must be evaluated by a third party and subsequently listed by the National Work Group on Leak Detection Evaluations (NWGLDE). All ATG systems must be third party certified to test for leaks at 0.2 gph on a monthly basis, with a 95% probability of detection, with no more than a 5% probability of false alarm as required by rule .04(1)(a)3.

INTRODUCTION

ATG systems were originally developed by petroleum tank system manufacturers as a method of determining the amount of fuel in a tank without the use of a tank gauging stick. The earliest versions of ATGs were essentially gauging sticks which a facility operator could use to determine how much fuel was present in a UST system. These readings were used to conduct monthly inventory control and no additional leak testing was conducted. As technology advanced, additional features were incorporated into the device. Water level measurements, product temperature, leak alarms, and eventually in-tank leak detection was developed and included by the Environmental Protection Agency (EPA) for use as a leak detection method.

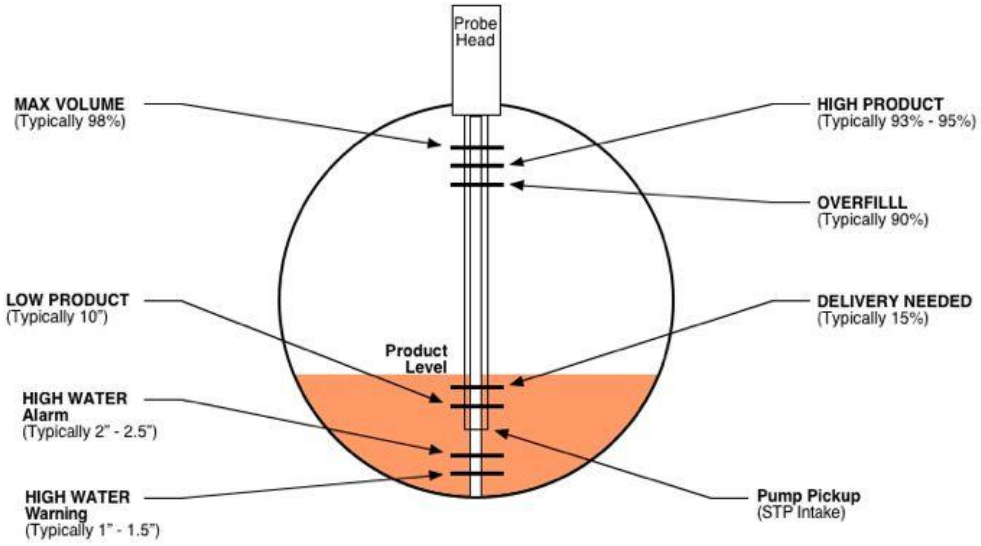
Today there are numerous manufacturers which produce ATG systems, each with its own features and benefits. As technology in the petroleum industry has advanced, most modern UST facilities are now equipped with an ATG which can measure liquid levels within an accuracy of $1/1000^{th}$ of an inch.



ATG systems consist of a tank probe mechanism installed in the tank that records information such as product level and temperature and a control panel inside the facility. The control panel is essentially a computer that communicates with the probes in one or multiple tank(s) as well as any sensors connected to it. The ATG console collects, interprets, and analyzes the information from the probes. Information from the ATG console is communicated to the operator via on-site or remote printer, audible/visual alarms, or a display monitor. Most ATG systems are capable of measuring the following:

- **Gross Volume**- the volume of product in the tank based on the product depth and the tank's depth to volume conversion factor.
- **Product temperature**- the average temperature of product in the tank.
- **Net volume**- temperature-compensated volume of product (calculated at 60 degrees Fahrenheit).
- **Water level**- the amount of water in the tank in inches/gallons.
- **Product level**- amount of the product in the tank in inches/gallons.
- **Ullage**- the capacity of the tank minus the gross volume of product, or empty space above the product level (usually expressed in gallons).
- **Net delivered product volume**- an automatic calculation of delivery volume based on before and after product level and temperature measurements. This volume is temperature compensated to 60 degrees F of product delivered.
- **Leak test result**- the results of the most recent as well as past leak tests. The result of a leak test may be PASS, FAIL, INVALID, INCREASE, or TEST ABORTED, etc. Some ATG systems may include the term SLOPE which is equivalent to the calculated leak rate.

ATG systems can be programmed to send audible/visual alarms when various problems exist. Most models include the following alarms:



~~Each ATG system must be evaluated by a third party and subsequently listed by the National Work Group on Leak Detection Evaluations (NWGLDE). All ATG systems must be third party certified to test for leaks at 0.2 gph on a monthly basis, with a 95% probability of detection, with no more than a 5% probability of false alarm~~.

DEFINITIONS:

Continuous In-Tank Leak Detection System (CITLDS): acronym used by Warren Rogers Associates for CITLDS, which is a third party approved leak detection method utilizing an ATG to collect multiple points of data for in-tank leak detection at high throughput facilities. These systems are designed to operate continuously while the tank is in normal operation.

Continuous Statistical Leak Detection (CSLD): another term also used to refer to continuous ATG systems

Leak Rate: a positive number expressed in gallons per hour (gph), measured by the test device that indicates the amount of product that may be leaking out of the tank system. A negative number may indicate that something was being added to the tank (delivery) or may be caused by a thermal effect due to product expansion.

Leak Threshold: the measured leak rate at which an ATG system determines the tank to be leaking. The leak threshold will always be less than or equal to the leak rate requirement for the ATG system. For typical ATG systems, the leak rate is set at 0.2 gph and the leak threshold is set at 0.1 gph.

Statistical Continuous Automatic Leak Detection (SCALD): acronym used by INCON (Franklin Fueling) ATG systems.

Tank Capacity: the volume of product a tank will hold in gallons. Tank capacities are reported as "nominal" ~~capacities which~~capacities which means the true capacity may be smaller or larger due to allowable tolerances in manufacturers' processes.

Test Period: the length of the leak test as determined by the third party evaluation. This is only applicable to static testing.

Ullage: the portion of unfilled space above the liquid level in an underground storage tank, usually expressed in gallons.

Waiting Time: minimum amount of time between fuel deliveries or dispensing before a leak test can begin.

90% Ullage: tank specific fuel level that the ATG system uses as a target threshold to ensure that tank overfills do not occur. This level is set at 90% of the entire tank capacity.

COMPONENTS OF AUTOMATIC TANK GAUGING SYSTEMS

1) Console- see photos on page 9.
2) Probe Types

For these types of ATG systems to operate properly, all leak tests must be performed during a period when no fuel is added to or removed from the tank.

a. Magnetostrictive
A magnetostrictive probe works on the principle that sound maintains a constant velocity despite temperature differences that may occur along its route of travel. When this principle is employed in an ATG system, a vertical pipe is installed in the tank. A wire runs down the center of the full length of the pipe. Around the outside of the pipe is a doughnut-shaped float that contains a strong magnet. Magnetic flux from this floating magnet impinges on the wire at the liquid level in the tank. For measurement of this level, a sound wave is injected into the top end of the wire and when the sound wave reaches the level of the magnetic float, the vibration of the wire causes electricity to be generated in the wire. With repeated calculation of the time between the start of the sound pulse and the start of the subsequent electrical pulse, the precise level of the float can be determined.

These probes described below in b. and c. do not work with ethanol blended fuels.

Formatted: Indent: Left: 0"

b. Capacitance

Certain ATG systems utilize capacitance type liquid measurement as a means of detecting changes in the depth of liquid in a storage tank. A hollow metal tube, with a smaller electronic tube running down its center, is installed vertically in an underground storage tank. The outside surface of the inside tube and the inside surface of the outside tube form the two plates of a capacitor. The space between them is a dielectric that serves essentially as an insulator between the two plates.

The outer tube is open at the bottom, and liquid in the tank rises in this tube. A small electric charge is stored on the inner tube. This electric charge seeks to pass through the dielectric to the opposite plate represented by the outer tube of the probe. Air (where no liquid is present) may be assigned a dielectric value of 1.

Gasoline, on the other hand, could be assigned a dielectric value of 2. Thus, the electric charge on the inner tube encounters a different resistance when it seeks to pass through the air than when it seeks to pass through the gasoline. The capacitance probe is capable of precisely sensing the amount of air versus the amount of liquid fuel present between the tubes.

This electronic property is then converted to a measurement of the liquid level in the tank.

The measurement is translated on a gauging instrument, outside the tank, to the volume of liquid present in the tank. When set in a leak detection mode, over a period of time the system can detect the presence of a leak in the tank.

~~**These probes described below in c. and d. do not work with ethanol blended fuels.**~~

c. Ultrasonic

A sensor detects sound wave echoes reflected from an interface of water/fuel or fuel/air to calculate the liquid level based on the speed of sound in the media.

Ultrasonic Probe

d. Mass measurement

Mass buoyancy probes operate on the Archimedes Principle, and measure the weight of a probe or load cell suspended in the fuel during the test period. Any changes in the weight of the suspended object can be converted to a volume change and the amount of fuel (in gallons/inches) in the tank can be determined. Mass buoyancy ATG measurements are not affected by changes in product temperature. However, they require a test period when nothing is added to or removed from the tank.

TYPES OF MONITORING METHODS FOR AUTOMATIC TANK GAUGING SYSTEMS

1) Static

This method is typically done by taking the tank out of service and putting the ATG into test mode on a monthly basis at a minimum. ATGs can be programmed to run static tests at any time. If a static test is being conducted and a consumer attempts to purchase fuel, it will invalidate the test result. The ATG might interpret this as a sudden loss. If a test has not been conducted at the end of the month, a tank owner has no monthly record for their release detection. See rule .04(3)(d)2. (See Appendix 14 for ATG reference guide).

2) Continuous

These systems may use different techniques; however, they share the characteristic of monitoring tank data continuously for days, weeks, or months, and then providing leak detection capabilities on demand once the initial data requirements are met. They may use many data items, including product height, product temperature, presence or depth of water, the tank chart or geometry, meter readings, delivery records, etc, collected continually. The advantage of using CITLDS is that tank systems using this method do not have to be taken out of service each month to conduct a static test. See rule .04(3)(d)3. CITLDS uses an ATG to collect product level measurements, and employs three different techniques to generate results.

Three techniques are described in the *Evaluation Protocol for Continuous In-Tank Leak Detection Systems Revision 1* dated January 7, 2000.

a. Continuous Automatic Tank Gauging

These systems use an ATG probe to collect data continually and combine this with software to identify time intervals when there is no activity in the tank and the data are stable enough for analysis. An algorithm then combines data from a number of such periods until there is enough evidence to make a determination about the leak status of the tank. This type of system functions like an ATG except that it does not require that the tank be taken out of service for a set period of several hours whenever a test is to be done. Instead, it uses data from shorter stable time periods and combines the results to estimate a leak rate and perform a test. The system may default to a standard or shut down ATG test (requiring the tank to be out of service for a few hours) at the end of the month if sufficient good quality data have not been obtained over the month.

Continuous ATGS may use the same probe in a tank as a similar ATG to collect temperature and level measurements and report them to a console. However, whereas an ATG requires a specified waiting time after a delivery and a further period of no dispensing or delivery operations while it conducts a leak test (a shut down period), the Continuous ATGS is designed to avoid such specified shut downs of normal tank operation. It does this by collecting data continuously. The software identifies segments of stable data, stores these data, and combines numerous such segments to produce a leak rate estimate that is used to determine whether the tank is tight or not. For high use tanks, a period of several days or weeks may be needed for the system to acquire sufficient data to make its determination. Once an adequate data base is obtained, a test can be conducted at any time by operator request. The test is based on the most recent data available. As new data are accumulated, older data are dropped, so that the leak rate estimate and test are based on the most current data. The total duration of the test period and the amount of data actually used in calculations will vary with the tank use pattern, the type of test being run (e.g., monthly or annual), and the quality of the current data.

b. Continuous In-Tank Leak Detection Systems (Continual Reconciliation)

These systems combine continuous product level and temperature monitoring from the tank with data from dispensing meters. Data from delivery records may also be included. In addition, these systems may address leaks or unexplained losses of product from the tank vessel, the pressurized lines, or a combination to monitor the tank and line system. These systems allow a combination of monitoring data from a static tank and inventory data from a dynamic tank to be combined in monitoring the system for a leak.

Continual reconciliation systems are related to statistical inventory reconciliation (SIR) systems. However, while SIR uses daily inventory records in the statistical analysis, the continual reconciliation systems use much more frequent inventory data. In addition, the continual reconciliation system may use initial data to develop a meter map, identifying meters with the tanks they draw product from. Furthermore, the continual reconciliation system may use data from the first month or so to do a tank calibration for each specific tank, providing a more accurate analysis of the data. Thus, the continual reconciliation systems differ from SIR systems in collecting and using more data from the tank records and in using much more frequent reconciliations as well as collecting some of the data automatically while also allowing for manual input.

REQUIREMENTS

An owner/operator is required to maintain documentation that the ATG system has performed at least one 0.2 gph leak test per month (i.e., every 30 days) for the previous 12 months. See rule .04(3)(d)2. and 3. Also, during an inspection performed by Division personnel, the ATG console must be accessible and an authorized representative who is familiar with operation of the ATG system must be present to generate inventory and setup reports every six years or if a problem is identified onsite (i.e. low product level) which will require a follow-up inspection with setup provided thereafter~~, or be able to obtain other information from the ATG console at the request of Division personnel~~ as required by rule .03(2).

The Division recommends that all ~~tank owners, operators, and~~ UST inspectors obtain a copy of the EPA document "Automatic Tank Gauging Systems for Release Detection: Reference Manual for Underground Storage Tank Inspectors". This document has been provided to every tank owner by the Division on the Annual Compliance Tool Box CD under Helpful Information, EPA Publications, Automatic Tank Gauge systems. The manual is also available on EPA's website at www.epa.gov/swerust1/pubs/automati.htm ~~Supplemental information has been developed since the original EPA document was published and is included below.~~

Examples of Automatic Tank Gauging Consoles

	
Veeder Root TLS-350	Veeder Root TLS-450

	
Incon Tank Sentinel (TS-1001)	Incon Tank Sentinel (TS-5000, TS-5)

	
Omntec OEM 4000	OPW EECO 1500

	
Red Jacket ST 1400	Pneumercator TMS 3000

1) 24-Hour UST Systems

High throughput or unmanned facilities frequently dispense fuel 24 hours a day and may not be capable of completing a 0.2 gph test. A common problem is that the ATG needs a minimum amount of "quiet time" where no fuel is delivered or dispensed in order to run a valid test. It may not be possible to get a valid test at a UST system open 24 hours a day. If a UST system is accessible 24 hours a day, then there should be enough "quiet time" to allow the ATG system to perform a valid leak test at least once per month.

2) Alarms Not Properly Investigated

~~The Division recommends that all owners/operators check the alarm status of the ATG system on a daily basis and that these alarms be addressed.~~ Owners and operators must address any alarms from the ATG system. During a UST Operations Inspection, Division staff should visually inspect the ATG console to verify there are no active alarms that have not been investigated. If any leak detection records are missing or incomplete, then the~~n~~ inspector~~s~~ must~~will~~ request a copy of the ATG system in-tank alarm history report to confirm there are no ongoing problems which require investigation. See rule .03(2). Examples of alarm history reports from various ATG consoles are shown in later sections of this ~~guidance~~ technical document. Failure to properly investigate leak alarms and report suspected releases to the Division within 72 hours is a violation of ~~the Tennessee Petroleum UST Regulations.~~ of rule .03(2)(a)2. and .05(1)(a)3.

3) Monthly Leak Test Reports Not Maintained

Even if a facility is equipped with an ATG, it does not guarantee compliance. Some tank owners rely on the ATG console's internal memory to store these records, and generate them upon request with a Leak History report. Leak history reports are acceptable, under rules .03(2)(b)4. and .04(5)(b), but electronic component failure due to electrical shortage, storms, or hardware problems frequently allow electronically stored records to be permanently lost. Therefore, it is the Division's recommendation that owners/operators not rely on the ATG leak history for maintaining monthly release detection records. A release could go undetected if monthly records are not reviewed. An owner/operator may be unaware if the ATG fails to produce a passing monthly record.

In addition, the Division recommends that ATG leak test reports be reviewed when they are printed ~~off~~ on a monthly basis. If the leak report indicates a leak (i.e., failing test, etc.), then, in accordance with ~~Division regulations~~, rules .03(2)(b)4., .04(3)(d)1.(ii), .04(3)(d)2.(ii), .04(3)(d)3.(ii), and .05(1)(a)3. the owner/operator shall report a suspected release to the Division within 72 hours. ~~If leak reports are not reviewed, then a release could go undetected for an extended period of time, resulting in expensive fines and cleanup costs.~~

4) Tank Owner/ Operator Unfamiliar with ATG Operation

If the facility operator is not familiar with the ATG functions, then a release may go undetected. Report any monthly failed leak test results as required by rules .03(2)(b)4., .04(3)(d)1.(ii), .04(3)(d)2.(ii), .04(3)(d)3.(ii), and .05(1)(a)3. Failure to do so may result in a civil penalty and jeopardize fund coverage for a release. An owner's manual should be available at the facility. Many ATG manuals may be downloaded from the manufacturers' website<u>s</u>.

5) Tank Fuel Volume Too Low for Valid Leak Test

All ATG probes are required to have a minimum product level in the tank in order to conduct a valid test in static test mode. It is possible for some ATG systems to produce passing results when the product level in the tank is below the minimum product level for a valid test. The Division does not consider tests conducted at insufficient product levels to be acceptable because rule .04(1)(a)2. requires methods of release detection to be "installed, calibrated, operated and maintained in accordance with the manufacturer's instructions, including routine maintenance and service checks for operability or running condition". The minimum product levels are specified in the NWGLDE list and the EPA ATG Reference Manual. These product levels may change based on reevaluations.

6) ATG Not Programmed Properly

Specific information that may not be programmed correctly include but may not be limited to, tank diameter and volume, tank material of construction, product type,

minimum product test level, leak detection threshold, high/low product level alarms and high water alarms. A qualified technician must reprogram these parameters if they are incorrect. Consult ~~Compliance Guidance Document (CGD) 110~~Technical Chapter 110(?) Requirements for Pressurized Piping for piping parameters if an electronic line leak detector is being used.

Rule .04(1)(a)2. requires release detection equipment to be "installed, calibrated, operated and maintained in accordance with the manufacturer's instructions, including routine maintenance and service checks for operability or running condition".

7) Third Party Evaluation for Large Capacity or Manifolded Tank Systems

Several ATG systems have not been third party evaluated for manifolded tank systems. Each tank in a manifolded tank system is required to have a separate ATG probe unless the ATG system is also using a continuous statistical leak detection system (CSLD or SCALD). The Division will not accept leak test reports from ATG systems that are not third party certified for the tank size the ATG system is monitoring as required by rules .04(1)(a)3., .04(3)(d)2.(ii), and .04(3)(d)3.(ii).

8) ATG System Not Routinely Inspected

Manufacturers recommend routine inspection and maintenance of equipment to ensure proper operation and detect deterioration of the probes, wiring or floats. And, ATG systems must be "maintained in accordance with the manufacturer's instructions" as required by rule .04(1)(a)2.

9) ATG Leak Threshold Set Incorrectly

The Division considers any leak threshold for monthly monitoring to be 0.1 gph. Any passing test result with a leak threshold greater than 0.1 gph is an invalid test result. A qualified technician must reprogram the leak threshold to 0.1 gph.

10) ATG used for Tank Tightness Testing

ATGs may not be used for tank tightness testing because they do not consider groundwater levels as required by rule .04(3)(c)2., and are not capable of testing the ullage space.

11) Probes with Ethanol-blended Fuels

Traditional water floats used on ATGs will not detect water incursion into a tank containing ethanol-blended fuels. This is problematic in that it does not provide any warning to the tank owner about increasing water levels in the fuel. ~~Currently, manufacturers offer floats that will float on the phase separation layer.~~ A probe that is not compatible with ethanol-blended fuels is not capable of detecting a release in accordance with rule .04(1)(a)3. and .04(3)(d)1.

12) Submittal of Inaccurate Records

Ensure records are for the correct facility. The ATG console must be accessible during the inspection and an authorized representative who is familiar with operation of the ATG system must be present to generate inventory and setup reports every six years or if a problem is identified onsite (i.e. low product level) which will require a follow-up inspection with setup provided thereafter.~~, or obtain other information from the ATG console at the request of the inspector.~~ ~~-~~If only the leak history (not monthly records) was provided in records submittal, then the leak history should be again printed off during the onsite inspection.

REASONS WHY TANK LEAK TESTS FAIL

1) An actual leak has occurred.

2) Temperature instability

Temperature variations of the product within the tank after a fuel delivery are the most common source of interference and failed leak tests/false alarms (a false positive or failure to detect an actual leak). Look at the hourly temperature data on the leak test report and retest if the variation in temperature is more than a few tenths of a degree. ~~-~~If leak test is being performed in static test mode, then do not begin the leak test until a sufficient period of time has passed since a fuel delivery has occurred. ~~-~~This period is called "waiting time" and is found in the NWGLDE listing for each ATG system.

3) Large changes in product temperature from the beginning to the end of the test.

This could be reported as an invalid test or as a failed leak test result.

4) Water level changes from the beginning to the end of the test.

5) Tank Deformation

The tank changes shape after a large product delivery.

6) Tank Cross-Talk

The fuel level changes in one tank causes a level change in an adjacent tank or compartment in manifolded tanks or compartments.

7) Product is being dispensed during a leak test.

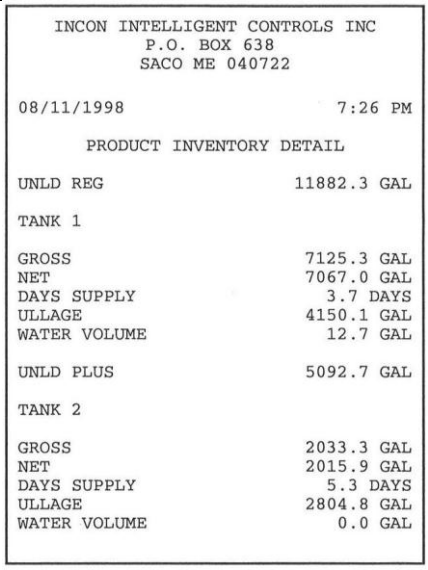
RECORDKEEPING

~~The Division requires~~ Rules .03(2)(b)4. And .04(5)(b) require that the previous 12 months of monthly 0.2 gph leak test results for each tank be properly maintained and be available for Division review. The Division also requires under rule .03(2), that someone who is familiar with the operation of the ATG system be present during an inspection and be able to generate the following information for review to ensure the ATG system is operational:

TYPES OF REPORTS

The following are examples of reports that may be generated.

1) In-Tank Inventory



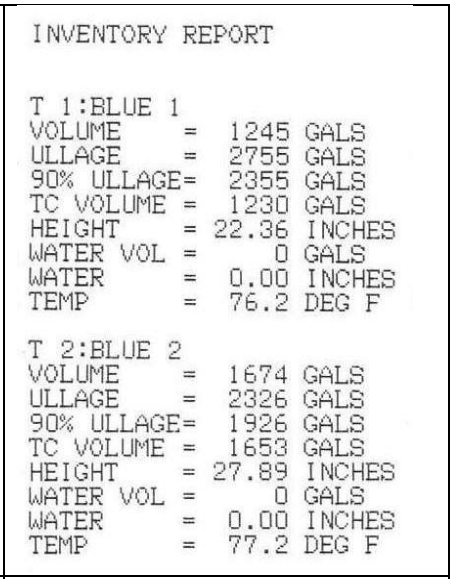
INCON INTELLIGENT CONTROLS INC
P.O. BOX 638
SACO ME 040722

08/11/1998 7:26 PM

PRODUCT INVENTORY DETAIL

UNLD REG	11882.3 GAL
TANK 1	
GROSS	7125.3 GAL
NET	7067.0 GAL
DAYS SUPPLY	3.7 DAYS
ULLAGE	4150.1 GAL
WATER VOLUME	12.7 GAL
UNLD PLUS	5092.7 GAL
TANK 2	
GROSS	2033.3 GAL
NET	2015.9 GAL
DAYS SUPPLY	5.3 DAYS
ULLAGE	2804.8 GAL
WATER VOLUME	0.0 GAL

Incon TS-1000 Inventory Report



INVENTORY REPORT

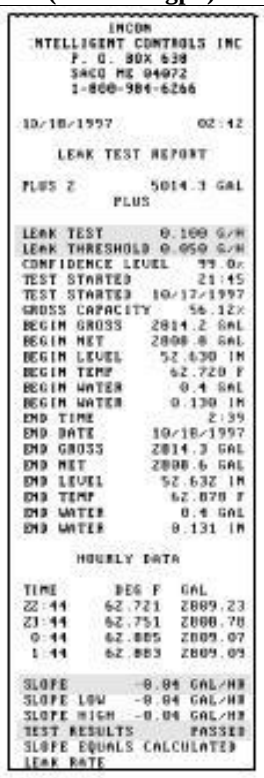
T 1:BLUE 1
VOLUME = 1245 GALS
ULLAGE = 2755 GALS
90% ULLAGE= 2355 GALS
TC VOLUME = 1230 GALS
HEIGHT = 22.36 INCHES
WATER VOL = 0 GALS
WATER = 0.00 INCHES
TEMP = 76.2 DEG F

T 2:BLUE 2
VOLUME = 1674 GALS
ULLAGE = 2326 GALS
90% ULLAGE= 1926 GALS
TC VOLUME = 1653 GALS
HEIGHT = 27.89 INCHES
WATER VOL = 0 GALS
WATER = 0.00 INCHES
TEMP = 77.2 DEG F

Veeder Root TLS-350 Inventory Report

A current inventory report for each tank should be reviewed during UST inspections to determine the presence of water in the tank and to properly identify each tank probe by name and product type.

2) Static Leak Test (0.2 or 0.1 gph)

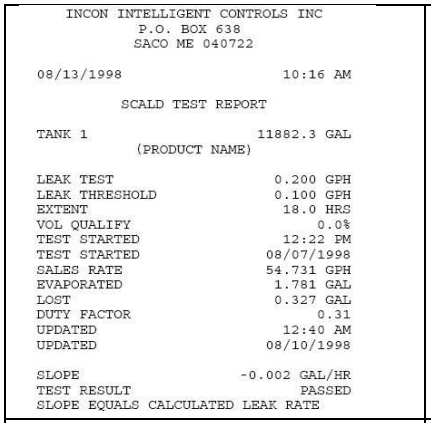
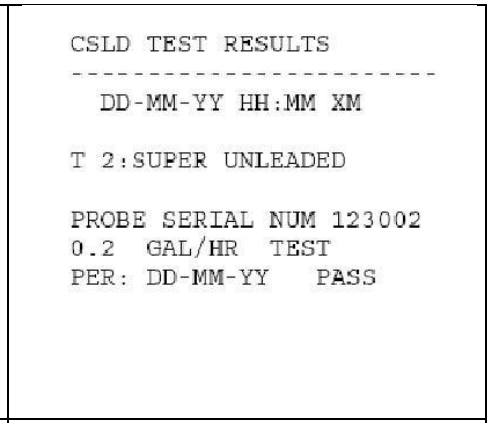


```
          INCON
 INTELLIGENT CONTROLS INC
     P. O. BOX 638
     SACO ME 04072
     1-800-984-6266

10/18/1997          02:12

    LEAK TEST REPORT

PLUS 2          5014.3 GAL
          PLUS

LEAK TEST       0.100 G/H
LEAK THRESHOLD 0.050 G/H
CONFIDENCE LEVEL    99.0%
TEST STARTED         21:45
TEST STARTED  10/17/1997
GROSS CAPACITY     56.12%
BEGIN GROSS    2814.2 GAL
BEGIN NET      2808.8 GAL
BEGIN LEVEL     52.630 IN
BEGIN TEMP      62.720 F
BEGIN WATER       0.4 GAL
BEGIN WATER      0.130 IN
END TIME             2:39
END DATE       10/18/1997
END GROSS      2814.3 GAL
END NET        2808.6 GAL
END LEVEL       52.632 IN
END TEMP        62.878 F
END WATER         0.4 GAL
END WATER        0.131 IN

      HOURLY DATA

TIME      DEG F   GAL
22:44    62.721  2809.23
23:44    62.751  2808.78
 0:44    62.805  2809.07
 1:44    62.883  2809.09

SLOPE          -0.04 GAL/HR
SLOPE LOW      -0.04 GAL/HR
SLOPE HIGH     -0.04 GAL/HR
TEST RESULTS       PASSED
SLOPE EQUALS CALCULATED
LEAK RATE
```

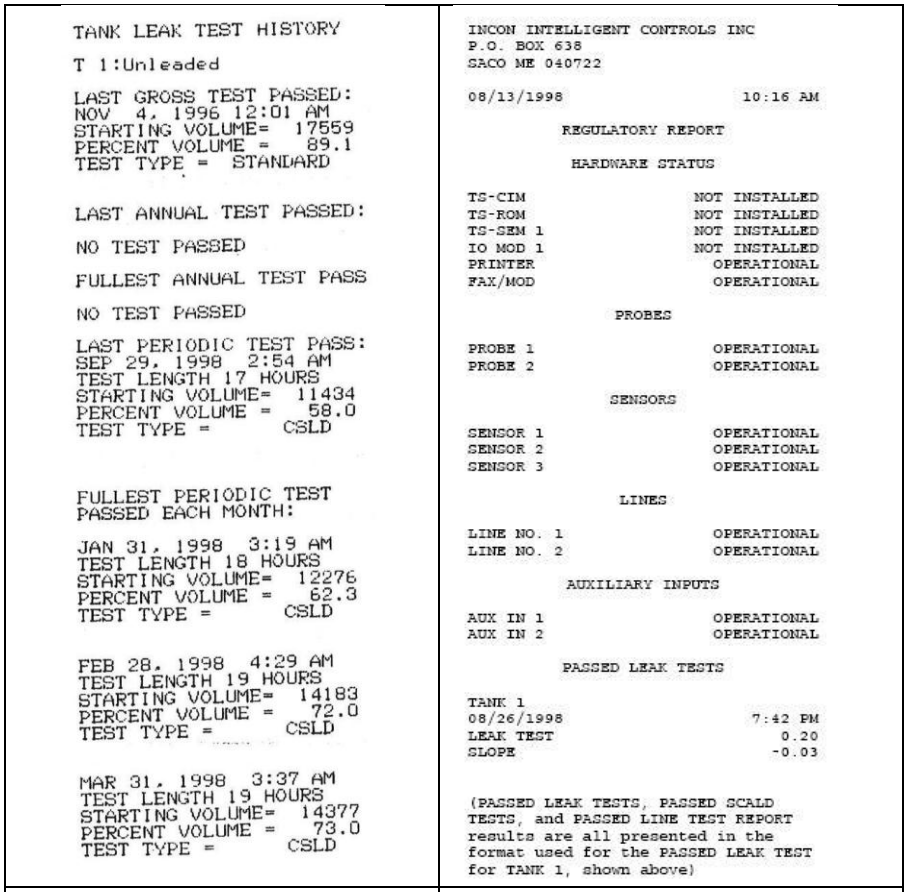
```
MMM DD, YYYY HH:MM XM

LEAK TEST REPORT

T 1: REGULAR UNLEADED
PROBE SERIAL NUM 105792

TEST STARTING TIME:
MM DD, YYYY HH:MM XM

TEST LENGTH = 4.3 HRS
STRT VOLUME = 3725 GALS

LEAK TEST RESULTS
0.2 GAL/HR TEST PASS
```

Incon TS-1000 Leak Test Report (static)	Veeder Root TLS-350 Leak Test Report

3) Continuous (CSLD or SCALD) Leak Test

	
Incon SCALD Leak Test Report	Veeder Root CSLD Leak Test Report

4) Tank Test Leak History



TANK LEAK TEST HISTORY

T 1:Unleaded

LAST GROSS TEST PASSED:
NOV 4, 1996 12:01 AM
STARTING VOLUME= 17559
PERCENT VOLUME = 89.1
TEST TYPE = STANDARD

LAST ANNUAL TEST PASSED:

NO TEST PASSED

FULLEST ANNUAL TEST PASS

NO TEST PASSED

LAST PERIODIC TEST PASS:
SEP 29, 1998 2:54 AM
TEST LENGTH 17 HOURS
STARTING VOLUME= 11434
PERCENT VOLUME = 58.0
TEST TYPE = CSLD

FULLEST PERIODIC TEST
PASSED EACH MONTH:

JAN 31, 1998 3:19 AM
TEST LENGTH 18 HOURS
STARTING VOLUME= 12276
PERCENT VOLUME = 62.3
TEST TYPE = CSLD

FEB 28, 1998 4:29 AM
TEST LENGTH 19 HOURS
STARTING VOLUME= 14183
PERCENT VOLUME = 72.0
TEST TYPE = CSLD

MAR 31, 1998 3:37 AM
TEST LENGTH 19 HOURS
STARTING VOLUME= 14377
PERCENT VOLUME = 73.0
TEST TYPE = CSLD

INCON INTELLIGENT CONTROLS INC
P.O. BOX 638
SACO ME 040722

08/13/1998 10:16 AM

REGULATORY REPORT

HARDWARE STATUS

TS-CIM	NOT INSTALLED
TS-ROM	NOT INSTALLED
TS-SEM 1	NOT INSTALLED
IO MOD 1	NOT INSTALLED
PRINTER	OPERATIONAL
FAX/MOD	OPERATIONAL

PROBES

PROBE 1	OPERATIONAL
PROBE 2	OPERATIONAL

SENSORS

SENSOR 1	OPERATIONAL
SENSOR 2	OPERATIONAL
SENSOR 3	OPERATIONAL

LINES

LINE NO. 1	OPERATIONAL
LINE NO. 2	OPERATIONAL

AUXILIARY INPUTS

AUX IN 1	OPERATIONAL
AUX IN 2	OPERATIONAL

PASSED LEAK TESTS

TANK 1
08/26/1998 7:42 PM
LEAK TEST 0.20
SLOPE -0.03

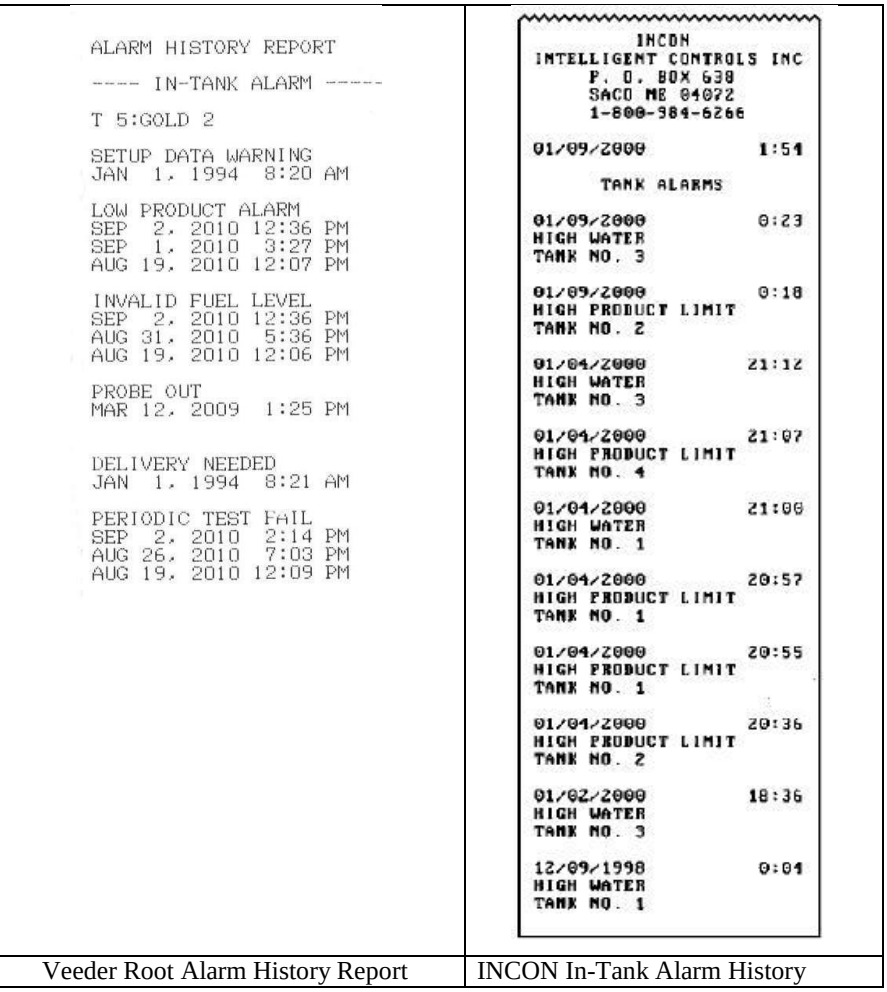
(PASSED LEAK TESTS, PASSED SCALD TESTS, and PASSED LINE TEST REPORT results are all presented in the format used for the PASSED LEAK TEST for TANK 1, shown above)

Veeder Root Leak History Report	INCON Regulatory Report

5) In-Tank Setup

IN-TANK SETUP - - - - - - - - - - - - T 2:DIESEL PRODUCT CODE : 2 THERMAL COEFF :.000450 TANK DIAMETER : 120.00 TANK PROFILE : 4 PTS FULL VOL : 19947 90.0 INCH VOL : 16201 60.0 INCH VOL : 9974 30.0 INCH VOL : 3746 METER DATA : YES END FACTOR: NONE CAL UPDATE: NEVER FLOAT SIZE: 4.0 IN. WATER WARNING : 3.0 HIGH WATER LIMIT: 3.5 MAX OR LABEL VOL: 19947 OVERFILL LIMIT : 90% : 17952 HIGH PRODUCT : 95% : 18949 DELIVERY LIMIT : 10% : 1994 LOW PRODUCT : 1500 LEAK ALARM LIMIT: 99 SUDDEN LOSS LIMIT: 999 TANK TILT : 0.56 PROBE OFFSET : 0.00 SIPHON MANIFOLDED TANKS T#: NONE LINE MANIFOLDED TANKS T#: NONE LEAK MIN PERIODIC: 20% : 3989 LEAK MIN ANNUAL : 20% : 3989 PERIODIC TEST TYPE STANDARD ANNUAL TEST FAIL ALARM DISABLED PERIODIC TEST FAIL ALARM DISABLED GROSS TEST FAIL ALARM DISABLED ANN TEST AVERAGING: OFF PER TEST AVERAGING: OFF TANK TEST NOTIFY: OFF TNK TST SIPHON BREAK:OFF DELIVERY DELAY : 5 MIN PUMP THRESHOLD : 10.00%	
TLS-350 In-Tank Setup Report	

6) In-Tank Alarm History



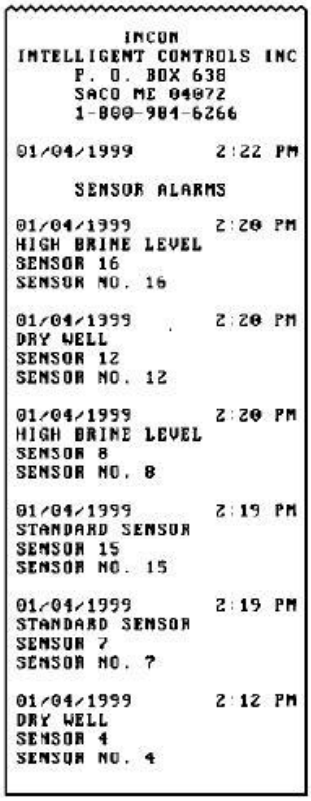
```
ALARM HISTORY REPORT

---- IN-TANK ALARM -----

T 5:GOLD 2

SETUP DATA WARNING
JAN  1, 1994  8:20 AM

LOW PRODUCT ALARM
SEP  2, 2010 12:36 PM
SEP  1, 2010  3:27 PM
AUG 19, 2010 12:07 PM

INVALID FUEL LEVEL
SEP  2, 2010 12:36 PM
AUG 31, 2010  5:36 PM
AUG 19, 2010 12:06 PM

PROBE OUT
MAR 12, 2009  1:25 PM


DELIVERY NEEDED
JAN  1, 1994  8:21 AM

PERIODIC TEST FAIL
SEP  2, 2010  2:14 PM
AUG 26, 2010  7:03 PM
AUG 19, 2010 12:09 PM
```

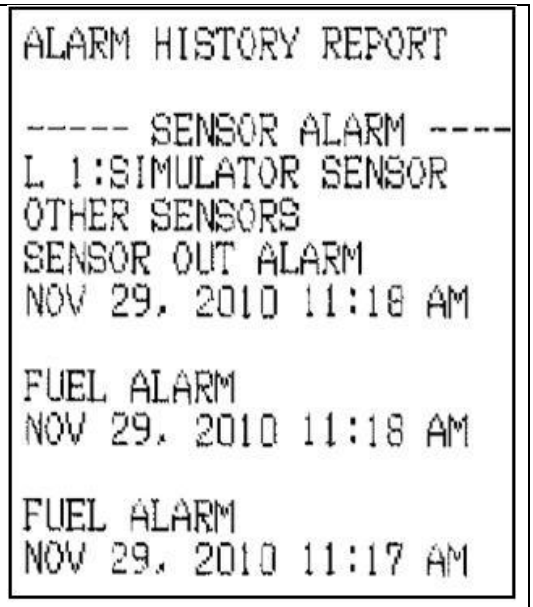
```
          INCON
INTELLIGENT CONTROLS INC
     P. O. BOX 638
     SACO ME 04072
     1-800-984-6266

01/09/2000          1:51

      TANK ALARMS

01/09/2000          0:23
HIGH WATER
TANK NO. 3

01/09/2000          0:18
HIGH PRODUCT LIMIT
TANK NO. 2

01/04/2000         21:12
HIGH WATER
TANK NO. 3

01/04/2000         21:07
HIGH PRODUCT LIMIT
TANK NO. 4

01/04/2000         21:00
HIGH WATER
TANK NO. 1

01/04/2000         20:57
HIGH PRODUCT LIMIT
TANK NO. 1

01/04/2000         20:55
HIGH PRODUCT LIMIT
TANK NO. 1

01/04/2000         20:36
HIGH PRODUCT LIMIT
TANK NO. 2

01/02/2000         18:36
HIGH WATER
TANK NO. 3

12/09/1998          0:04
HIGH WATER
TANK NO. 1
```

Veeder Root Alarm History Report	INCON In-Tank Alarm History

The in-tank alarm history report will indicate whether any failed test results were recently generated by the ATG. This report must be provided to inspectors onsite when there are missing or incomplete ATG leak test reports.

7) Sensor Alarm History



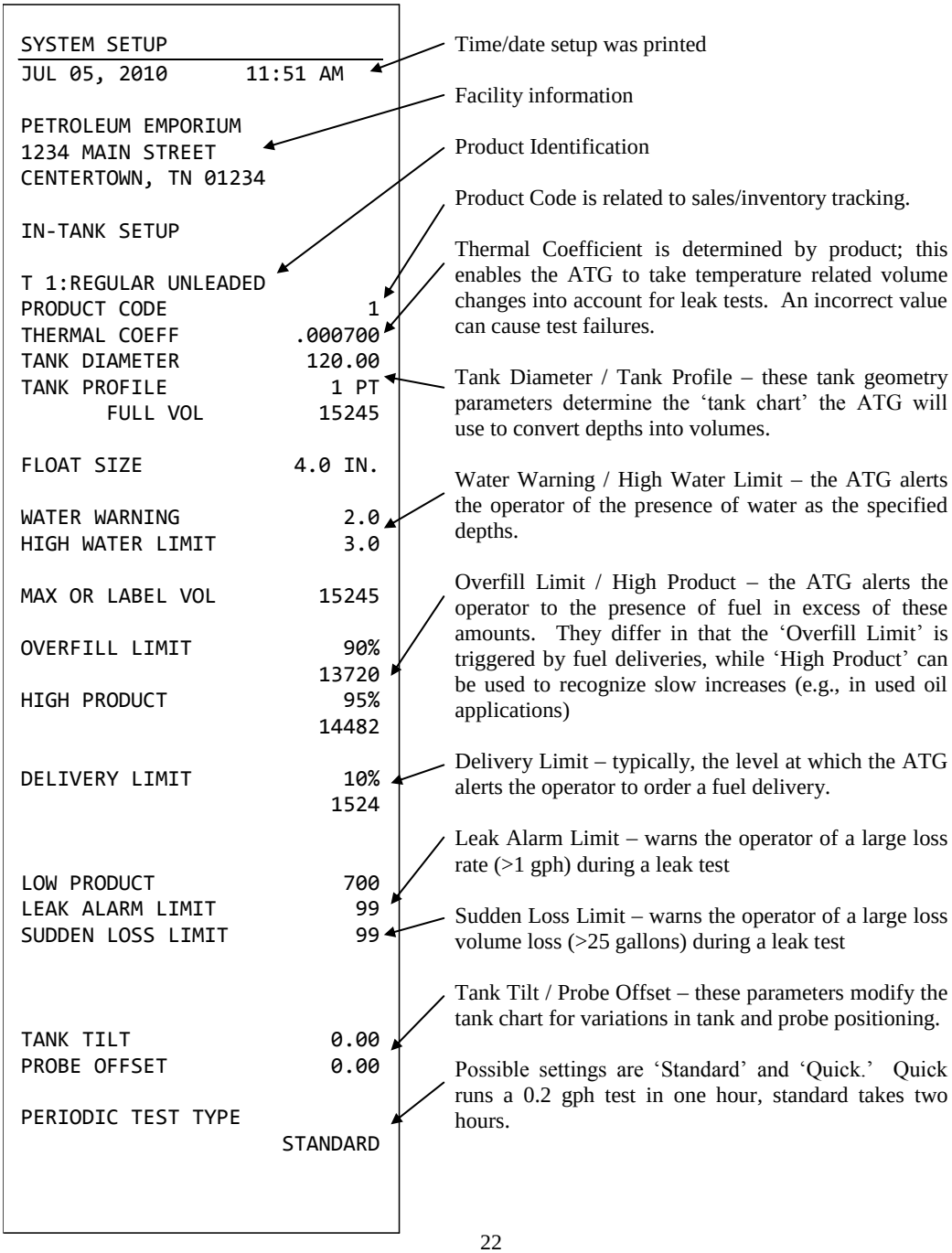


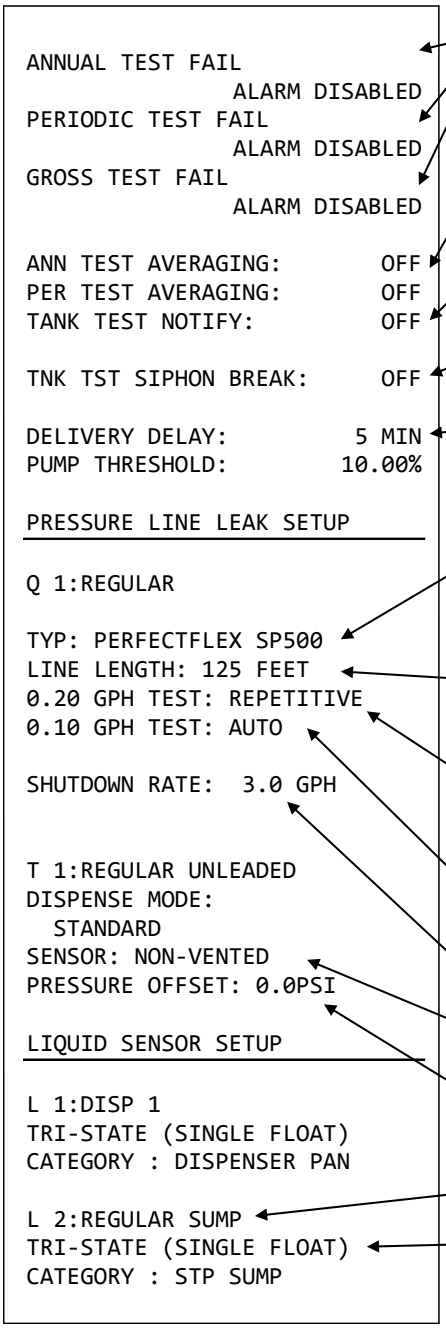
INCON Sensor Alarm History	Veeder Root Sensor Alarm History

INTERPRETATION OF SETUP INFORMATION TO BE REVIEWED ONSITE

Setup information from the ATG will be reviewed during the onsite inspection every six years or if a problem is identified onsite (i.e. low product level) which will require a follow-up inspection with setup provided thereafter. ~~.~~ Below are examples of setup information of commonly found for ATGs in Tennessee.

VEEDER-ROOT TLS-3XX SETUP:





Alarm settings for different types of tests. The annual test is 0.1 gph, periodic test is 0.2 gph and the gross test is 3 gph.

Annual Test Averaging averages the last ten 0.1 gph tests. Periodic Test Averaging averages the last five 0.2 gph tests.

Test Notify – gives the operator an opportunity to shut off the submersible pump for a test.

Used to perform in-tank leak tests on some manifolded tanks.

This delay allows the tank to "settle out" after a delivery before the system generates a 'Delivery Increase Report.' Can be up to 99 minutes.

Brand/type of piping – there are a number of pre-programmed options. If set as 'User Defined', the bulk modulus of the pipe must be entered manually as a separate parameter.

Total length of piping for the specified product; unrealistically high values will cause an ELLD to miss leaks, particularly with flexible pipe.

'Repetitive' test means that a 0.2 gph line test is run after every dispensing event, immediately after the 3,0 gph test.

'Auto' means that a 0.1 gph test is automatically run every six months.

Leak rate setting for automatic pump shutdown.

LLD type.

Pressure setting adjustment for high geographic elevations.

Sensor location

Sensor type

INCON TANK SENTINEL SETUP:

```
     PETROLEUM EMPORIUM
       1234 MAIN STREET
     CENTERTOWN, TN 01234

 JUL 05, 2010       11:51 AM

     SYSTEM SETUP REPORT

LIMITS
 LEAK LIMIT                2.00
 LEAK LIMIT O/G            NONE
 THEFT LIMIT              10.00
 THEFT LIMIT O/G           NONE


TANK

 NUMBER OF TANKS              2

 TANK 1
  NAME                  REG UNL
  TANK SHAPE         HORIZONTAL
  TANK TYPE           SPECIAL 1
  PROBE                 PROBE 1
  PRODUCT             PRODUCT 1
  MANIFOLD                NONE
  PROD OFFSET            0.000
  WATER OFFSET          -0.816
  DEL THRESHOLD            200
  HIGH HIGH LIM        118.000
  HIGH HIGH O/G           NONE
  HIGH LIMIT           116.000
  HIGH LIMIT O/G          NONE
  LOW LIMIT              500.0
  LOW LIMIT O/G           NONE
  LOW LOW LIMIT          400.0
  LOW LOW O/G             NONE
  WATER LIMIT            3.000
  WATER O/G               NONE
```

Facility information and date of system setup report.

Leak limit is a parameter that checks for fuel loss when the facility is shut down; whereas, theft limit checks for excess fuel being removed while fuel is being dispensed. The O/G or output group parameters tell the tank monitor what action to take (i.e. sound an alarm, send an email, etc.). O/G is typically set at "none" or a letter between A and FF.

Number of tanks at this facility.

Special 1, Probe 1, and Product 1 correspond to various tank, probe and product parameters listed in a different portion of the setup report

Product and/or water offset are used to compensate for product/water reading from tilted tanks

Del Threshold = minimum volume added to tank before delivery is reported on ATG

High Limit and High High Limit represent various degrees of tank fullness with High High representing the fullest level (typically set in inches of product)

High High O/G, High Limit O/G, Low Limit O/G, Low Low O/G and Water O/G represent the actions that the tank monitor takes if any of these conditions exists. For example, the ATG might sound and alarm, email the contact person, do nothing, etc. Value entered is either "none" or a letter between A and FF.

Low Limit and Low Low Limit represent various degrees of tank emptiness with Low Low representing the lowest level of product in a tank (typically set in gallons of product)

Water limit represent the water level (in inches) needed to trigger a high water alarm

```
 SPECIAL TANKS
  SPECIAL 1
   DIAMETER          120.000
   LENGTH            205.700
   CORRECTION POINTS       0




 PROBES
  PROBE 1
   TYPE               STD 125
   GRADIENT           8.99634
   RATIO     1:1 TIP TO HEAD
   FLOATS           2 FLOATS
   FLOAT TYPE       GASOLINE




PRODUCTS

 PRODUCT 1
  NAME                REG UNL
  TYPE          UNLEADED REG


LINES

 NUMBER OF LINES            2

 LINE 1
  NAME                 LINE 1
  TEST FAIL O/G          NONE
  TEST FAULT O/G         NONE
 LINE 2
  NAME                 LINE 2
  TEST FAIL O/G          NONE
  TEST FAULT O/G         NONE
```

Special Tanks contains tank specific dimension and correction factors. Correction points allows the ATG to adjust fuel reading to match data for that tank. For example, you may put 500 gallons of product in a tank, but the tank monitor only reads 450 gallons, so a correction factor would be entered. Numerous correction factors can be entered.

Probe type is selected from a type already programmed into ATG; Gradient is entered from probe label and **is unique to each probe**; ratio corresponds to a correction factor (example, 1:8 would indicate that 1 inch of change indicated by the probe would correspond to 8 inches in the tank; typically used for ASTs; for UST should typically be 1:1); floats are either "2 Floats" or "1 Float" (2 floats corresponds to the product and water float); and float type is either "gasoline" or "oil"

Product = Unleaded Reg, Unleaded Pls, Unleaded Xtr, Unleaded Sup, Diesel, Kerosene, #2 Fuel Oil, Ethanol, or Special (additional information needed if product type is "special")

Number of lines, the line names, and what actions the ATG needs to take in the event of fail (i.e. alarm, etc.) or test fault. Test faults are typically related to computer glitches which cause the test to not run properly.

```
LEAK TEST
 CONFIDENCE                99.0%
 MIN TEST TIME                2
 MAX TEST TIME                8
 LEAK TEST
  TANK 1                    0.20
  TANK 2                    0.20
 TEST SCHEDULES
  TANK 1
   SCHEDULE                DAILY
   TIME                 01:00 AM
  TANK 2
   SCHEDULE                DAILY
   TIME                 01:00 AM
 ALARM ON TEST FAIL          YES


SCALD TESTS


 CONFIDENCE                95.0%
 LEAK TEST                 0.20
 INTERVAL                    18
 VOLUME QUALIFY            0.0%
 VAPOR RECOVERY         DISABLED
 SCALD ENABLED
  TANK 1                 ENABLED
  TANK 2                 ENABLED

ALARM ON TEST FAIL          YES
TEST FAIL O/G
 TANK 1              ALL GROUPS
 TANK 2              ALL GROUPS
```

Leak test contains data on leak rate, frequency, etc. for when the tank monitor is to perform a static leak test. For example, the setup to the left indicates that the 0.2 gph leak test will be performed daily starting at 1:00 AM. Test confidence must be greater than 95%. Min test time refers to the time needed to complete a leak test (set in hours). Ranges from approx. 2 hours for a 4,000 gallon tank to 5 hours for a 10,000 gallon tank to 8 hours for a 20,000 gallon tank. Alarm on test fail represents the action that the ATG will take in the event of a failure.

SCALD = Statistical Continuous Automatic Leak Detection performs volumetric leak tests during the quiet time between dispenses.

Interval is related to temperature compensation during the leak test (default IS 18)

Volume Qualify is the minimum liquid volume for which a leak test can be performed. Refer to the "National Work Group on Leak Detection Evaluations" website for the minimum tank volumes needed to perform a valid leak test. Should never be set at 0!

SCALD Enabled represent which tanks are performing SCALD leak detection (i.e., enable or disabled)

Test fail o/g (output group) represents the action that the ATG will take in the event of a failure. Could be "none", A through FF, or "all groups". All groups indicates that all actions programmed into all relay groups (i.e. A through FF) will occur.

```
LINE TESTS

0.1 GPH TEST SCHEDULES
  LINE 1
    SCHEDULE              DAILY
    TIME               01:00 AM
  LINE 2
    SCHEDULE              DAILY
    TIME               01:00 AM

0.2 GPH TEST SCHEDULES

  LINE 1
    SCHEDULE              DAILY
    TIME               01:00 AM
  LINE 2
    SCHEDULE              DAILY
    TIME               01:00 AM


SENSORS
  NUMBER OF SENSORS          3
    SENSOR 1               STD
    RELAY               RELAY 1
    NAME               1 2 DISP
    STD O/G          ALL GROUPS
    SENSOR 2               STD
    RELAY               RELAY 1
    NAME               3 4 DISP
    STD O/G          ALL GROUPS
    SENSOR 3               STD
    RELAY               RELAY 1
    NAME               UNL SUMP
    STD O/G          ALL GROUPS
```

Time and frequency that lines are scheduled to be tested at the 0.1 GPH and/or 0.2 GPH leak test levels. Schedule could vary between none, daily, a certain day of the week and/or month.

STD corresponds to a standard sensor type in the ATG setup and STD O/G corresponds to the action that the ATG will take in the event of an alarm.

For Veeder Root and INCON models used for CSLD, the probability of detection ~~should~~ can be set at 95% or 99%. Any leak detection method installed after December 22, 1990 must be capable of detecting a leak rate with a probability of detection of ninety-five (95) percent and a probably of false alarm no greater than five (5) percent, in accordance with rule .04(1)(a)3. ~~as demonstrated in the third party evaluation and required by rules .04(1)(a)2. and 3. and .04(3)(d)3.(ii). This can be verified by reviewing in-tank leak test setup. If set at 95%, it should be reprogrammed to 99% to be considered valid.~~

Formatted: Space Before: 12 pt

Upon transfer of ownership, including, but not limited to, sale of the UST systems, originals and/or copies of all documents required to satisfy the reporting and recordkeeping requirements shall be transferred as required by rules .03(2)(d) and .02(7)(f), to the new owner of the USTs at the time of ownership transfer.

REPORTING

If any of the following conditions are observed, then ~~contact~~ the Division should be contacted to report a suspected or confirmed release with 72 hours as required by rule .05(1)(a):

- Results of any failed 0.1 gph or 0.2 gph leak tests from the ATG, unless the monitoring device or an associated UST component is found to be defective but not leaking, is immediately repaired, and a follow-up test does not confirm the initial result as required by rule .05(1)(a)3.

- Any in-tank alarm from the ATG which indicates a sudden or unexplained loss of product as required by rule .05(1)(a)2. Documentation of investigation of all in-tank leak alarms should be kept with the ATG leak test reports for review by Division staff.

- Any released petroleum product at the UST site or in the surrounding area (such as the presence of free product~~liquid petroleum~~, ~~soil contamination~~, ~~surface water or groundwater contamination~~, or petroleum vapors in soils, basements, sewer and utility lines and nearby surface water) . See rule .05(1)(a)1.

REFERENCES

Automatic Tank Monitoring and Leak Detection Reference Manual, U.S. EPA, Region 7

Automatic Tank Gauging Systems for Release Detection: Reference Manual for Underground Storage Tank Inspectors, August 2000

Getting the Most Out of Your Automatic Tank Gauging System, EPA 510-F-98-011

Kentucky DEP UST Inspector Handbook, May 2006

Petroleum Equipment Institute

Wisconsin COMM 10 Material Approval # 20050005, Automatic Tank Gauging, Dec. 2009

Wisconsin COMM 10 Material Approval # 20020011, Incon Series, Dec. 2007

INCON TS-5 Series Operator's Manual

Underground Storage Tanks- The Basics, Iowa Department of Natural Resources, Underground Storage Tank Branch, March 2010

APPENDICES-

1. ~~Third Party Evaluation Summary (not included in EPA Manual)~~
2. ~~Suggested Periodic Maintenance for ATG and Sensors~~
3. ~~Recommended Practices for ATG Systems~~
- ~~Automatic Tank Gauge Checklist for Mass Buoyancy Probes~~
- ~~Automatic Tank Gauge Checklist for Magnetostrictive and Ultrasonic Probes~~

4. Wisconsin ATG Leak Detection Quick Reference Table ~~Need to add~~

~~APPENDIX 1~~

~~Third Party Evaluation Summary for Veeder Root TLS-450, INCON TS-5 Series, and INCON Colibri Tank Monitors~~

~~Veeder-Root TLS-450 (Models 8463, 8473, 8493 Magnetostrictive Probes)~~

~~Certification~~	~~Leak rate of 0.2 gph with PD = 98.9% and PFA = 0.3%.~~ ~~Leak rate of 0.1 gph with PD = 95.8% and PFA = 0.9%.~~
~~Leak Threshold~~	~~0.126 gph for leak rate of 0.2 gph, 0.071 gph for leak rate of 0.1 gph.~~ ~~A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.~~
~~Applicability~~	~~Gasoline, diesel, aviation fuel. Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.~~
~~Tank Capacity~~	~~Maximum of 30,000 gallons. Tanks less than 95% full may be tested. Minimum product level required is based on tank diameter as follows: 48" dia/ min 18", 64" dia/ min 21", 72" dia/ min 24", 96" dia/ min 30", 126" dia/ min 39". For other tank diameters, see evaluation report.~~
~~Waiting Time~~	~~Minimum of 8 hours between delivery and testing. Minimum of 30 minutes between dispensing and testing. There must be no delivery during waiting time.~~
~~Test Period~~	~~Minimum of 2 hours for leak rate of 0.2 gph.~~ ~~Minimum of 3 hours for leak rate of 0.1 gph.~~ ~~Test data are acquired and recorded by system's computer. Leak rate is calculated from the difference between the first and last data collected. There must be no dispensing or delivery during test.~~

~~Temperature~~	~~Average for product is determined by probe which contains 5 thermistors. At least one thermistor must be submerged in product during test.~~
~~Water Sensor~~	~~Must be used to detect water ingress. Minimum detectable water level in the tank is 0.544 inch. System is programmed to report water depth only when it exceeds 0.75 inch. Minimum detectable change in water level is 0.027 inch.~~
~~Calibration~~	~~Thermistors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.~~
~~Comments~~	~~Not evaluated using manifolded tank systems. Therefore, this certification is only applicable when there is a probe used in each tank and the siphon is broken during testing. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank which routinely contains product.~~

Formatted: Heading 4
Formatted: Heading 4, Centered
Formatted: Heading 4
Formatted: Heading 4, Centered
Formatted: Heading 4
Formatted: Heading 4, Centered
Formatted: Heading 4
Formatted: Heading 4, Centered
Formatted: Heading 4, Centered

Formatted: Font: 12 pt, Font color: Auto
Formatted: Font: 12 pt, Font color: Auto
Formatted: Heading 4

~~INCON TS5 Series (Franklin Fueling)~~

~~INCON Colibri (Franklin Fueling)~~

Formatted: Heading 4
Formatted: Heading 4

~~Both ATG systems listed above utilize the Incon Magnetostrictive probe~~

~~Certification~~	~~Leak rate of 0.2 gph with PD = 95.7% and PFA = 4.3%. Leak rate of 0.1 gph with PD = 99.9% and PFA = 0.1%.~~
~~Leak Threshold~~	~~0.1 gph for leak rate of 0.2 gph., 0.05 gph for leak rate of 0.1 gph. A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.~~
~~Applicability~~	~~Gasoline, diesel, aviation fuel, fuel oil #4, biodiesel blends, B6-B20 meeting ASTM D7647, biodiesel B100 meeting ASTM D6751. Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.~~

Formatted: Heading 4, Centered, Space After: 0 pt
Formatted: Heading 4
Formatted: Heading 4, Centered, Space Before: 0 pt, After: 0 pt
Formatted: Heading 4
Formatted: Heading 4, Centered

Tank Capacity	Maximum of 30,000 gallons for leak rate of 0.2 gph., maximum of 15,000 gallons for leak rate of 0.1 gph. Tanks less than 95% full may be tested. Minimum product level required based on tank diameter is as follows: 48" dia/min 12", 64" dia/min 14", 72" dia/min 15", 96" dia/min 17.5", 126" dia/min 21.5", For other tank diameters, see evaluation report.
Waiting Time	Minimum of 4 hours 9 minutes between delivery and testing for leak rate of 0.2 gph. Minimum of 5 hours 18 minutes between delivery and testing for leak rate of 0.1 gph. None between dispensing and testing. There must be no delivery during waiting time
Test Period	Length of the test is determined automatically based on quality of test data. Average data collection time during evaluation was 6 hours, 51 minutes for leak rate of 0.2 gph. Average data collection time during evaluation was 5 hours 44 minutes for leak rate of 0.1 gph. Test data is acquired and recorded by system's computer. Leak rate is calculated from data determined to be valid by statistical analysis. There must be no dispensing or delivery during the test.
Temperature	Probe contains 5 thermistors to monitor product temperature. At least one thermistor must be submerged in product during testing.
Water Sensor	Must be used to detect water ingress. Minimum detectable water level in the tank is 0.208 inch. Minimum detectable water level change is 0.011 inch.
Calibration	Thermistors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.
Comments	Not evaluated using manifolded tank systems. Therefore, this certification is only applicable when there is a probe used in each tank and the siphon is broken during testing. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Formatted: Heading 4
Formatted: Heading 4, Centered, Space Before: 0 pt, After: 0 pt
Formatted: Heading 4
Formatted: Heading 4, Centered, Space Before: 0 pt, After: 0 pt
Formatted: Heading 4
Formatted: Heading 4, Centered, Space Before: 0 pt, After: 0 pt
Formatted: Heading 4
Formatted: Heading 4, Centered, Space Before: 0 pt, After: 0 pt
Formatted: Heading 4
Formatted: Heading 4, Centered, Space Before: 0 pt, After: 0 pt
Formatted: Heading 4
Formatted: Heading 4, Centered
Formatted: Heading 4
Formatted: Heading 4, Centered
Formatted: Heading 4

APPENDIX 2

Suggested Periodic Maintenance for Automatic Tank Gauges and Sensors

As published by the Colorado Department of Labor and Employment, Division of Oil and Public Safety, July, 2001

Maintenance Operation	What To Do or Check	Check if done
Automatic Tank Gauge Console	**Owner or Station Attendant** 1. Check printer for paper. 2. Print out or check system inventory and verify to actual inventory. 3. Print out or record system setup values, then verify if battery backup is working by powering the unit down and then back up with the circuit	

	breaker. If programming is lost, the battery is bad and the unit needs service. 4. Verify in-tank tests are being performed as required by printing reports. 5. Press Alarm/Test button to verify power, warning and alarm indicators light and audible alarm sounds. 6. Verify line leak tests are being performed if line leak installed.	
Automatic Tank Gauge Probes	**Owner or Station Attendant** 1. Inspect probe cables for any cracking or swelling. **Vendor Technician** 2. Replace probe cables if necessary. 3. Verify epoxy kits have been installed on field wiring. 4. Magnetostrictive probes only-Inspect floats and probe shaft for any residue build up. Clean if necessary. 5. Capacitance probes only-Run diagnostic check on probe and verify there are no open or shorted segments.	
Volumetric Line Leak Detection System	**Owner or Station Attendant** 1. During or immediately after running at 3.0 gph self-test, visually inspect the flexible fuel lines for leakage. 2. Check flexible fuel control lines for any chafing or excessive corrosion. **Vendor Technician** 3. Replace check valve filters if necessary. 4. Verify epoxy kits have been installed on field wiring.	
Pressurized Line Leak Detector	**Owner or Station Attendant** 1. Check submersible pump head for leakage at PLLD port and functional element with pump on. 2. Check line leak sensor cable for any cracking or damage. **Vendor Technician** 3. Verify epoxy kits have been installed on field wiring. 4. Replace sensor if cables are cracked or damaged.	
Wireless Pressurized Line Leak Detector	**Owner or Station Attendant** 1. Check submersible pump head for leakage at WPLLD port and functional element with pump on.	
Piping Sump Sensor (float type)	**Owner or Station Attendant** 1. Inspect sensors to verify float moves freely. 2. Turn sensor upside down to verify the monitor liquid alarm is activated. **Vendor Technician** 3. Verify epoxy kits have been installed on field wiring.	
Dispenser Pan Sensor	**Owner or Station Attendant** 1. Inspect sensor cables for any cracking or swelling. 2. Verify sensor is firmly secured in an upright position on the bottom of the pan. **Vendor Technician** 3. Verify epoxy kits have been installed on field wiring. 4. Replace sensor if cables are cracked or damaged.	
Containment Sump Sensor	**Owner or Station Attendant** 1. Inspect sensor cables for any cracking or swelling. 2. Verify sensor is firmly secured in an upright position on the bottom of the	

	containment sump. **Vendor Technician** 3. Verify epoxy kits have been installed on field wiring. 4. Replace sensor if cables are cracked or damaged.	
Vapor Sensor	**Owner or Station Attendant** 1. Inspect sensor cables for any cracking or swelling. **Vendor Technician** 2. Verify epoxy kits have been installed on field wiring. 3. Replace sensor if cables are cracked or damaged.	
Groundwater Sensor	**Owner or Station Attendant** 1. Inspect sensor cables for any cracking or swelling. 2. Lift sensor above water level in the well and verify the system activates a "Water Out" alarm. **Vendor Technician** 3. Verify epoxy kits have been installed on field wiring. 4. Replace sensor if cables are cracked or damaged. 5. If the sensor does not alarm (item 2 above) replace the sensor.	
Hydrostatic Sensor	**Owner or Station Attendant** 1. Inspect sensor cables for any cracking or swelling. **Vendor Technician** 2. Remove sensor from brine reservoir and verify floats move freely. With sensor in its upright position, the system should activate a "Fuel Alarm". Turn the sensor upside down to be sure the system activates a "Water Alarm". If the sensor does not alarm in both conditions, replace the sensor. 3. Verify epoxy kits have been installed on field wiring. 4. Replace sensor if cables are cracked or damaged.	

APPENDIX 3

Automatic Tank Gauge Checklist for Mass Buoyancy Probes

From the National Work Group on Leak Detection Evaluations List, April, 1997

ATG MAINTENANCE CHECKLIST **Mass Buoyancy Probes**		
Minimum procedures to be conducted by a *qualified service technician.*		
Has all input wiring been inspected for proper entry and termination, including testing for ground faults?	Yes	No
Has the probe been checked for visible damage (such as residue buildup or cracks)?[1]	Yes	No
Has the battery been tested within the last 3 months?	Yes	No
Has the accuracy of the product sensor been tested?[2]	Yes	No
Has the accuracy of the water sensor been tested?[3]	Yes	No
Has the appropriateness of high-water level alarm setting been verified?[4]	Yes	No
Are all alarms activated and functioning properly?	Yes	No
Comments:		

1. Damaged probes must be cleaned or replaced, as appropriate. The mass displacement probe is very susceptible to dirt and residue build-up and should be checked semi-annually and cleaned, if necessary. Mass displacement probes used in viscous products such as waste oil should be checked more frequently. Products of this type can leave heavy deposits on the probe which may inhibit the accuracy of the probe. Checking a reconciliation report and/or manual sticking could verify the system's accuracy.

2. To test the accuracy of the product sensor:
   a. Using the tank console monitor, take an initial fuel level reading.
   b. Dispense one gallon of product into a calibrated container.
   c. Using the tank console monitor, take a second fuel level reading.
   d. Verify that the change in tank volume is one gallon.

3. To test the accuracy of the water sensor: (Note: water sensor is separator from the mass buoyancy probe.)
   a. Remove the probe from the tank.
   b. By hand, move the water float up the probe to a point higher than the high water limit.
   c. The monitor should respond with a high water alarm. (The water height may also appear on the tank monitor display console.)
   d. Check this height against its actual location.

4. The high water level alarm should not be set so high that water ingress into the tank goes undetected for long periods of time.

Disclaimer: *This checklist is not intended to tell the technician how to perform the maintenance and system check. Technicians should follow manufacturer's detailed instructions while making sure that all of the items on this checklist have been covered.*

APPENDIX 3

Automatic Tank Gauge Checklist for Magnetostrictive and Ultrasonic Probes

From the National Work Group on Leak Detection Evaluations List, April, 1997

ATG MAINTENANCE CHECKLIST Magnetostrictive and Ultrasonic Probes		
Minimum procedures to be conducted by *a qualified service technician*.		
Has all input wiring been inspected for proper entry and termination, including testing for ground faults?	Yes	No
Have the probe and sensors been checked for visible damage such as residue buildup, cracks, or breaks? [1,2]	Yes	No
Has the accuracy of the level sensor been tested? [3]	Yes	No
Has the accuracy of the water sensor been tested? [4]	Yes	No
Has the appropriateness of the high water level alarm setting been verified? [5]	Yes	No
Are all alarms activated and functioning properly?	Yes	No
Comments:		

1. Damaged probes must be cleaned or replaced as appropriate. Probes used in heavier products such as waste oil should be checked more frequently. Heavier products can leave deposits on the probe shaft and float assemblies that may restrict the measurement capacity of the probe.
2. Because the magnetostrictive probe consists of moving parts, its sensors can be damaged by excessive frictional wear as well as residue build up. Residue build up can affect the weight of the sensor as well as inhibit its ability to slide freely along the guide tube. Inaccuracies in the product level measurements could indicate a problem with the probe sensors. For additional testing of the probe sensors, perform the following test:
   a. Remove the probe from the tank and place it carefully on the ground.
   b. Place the water sensor flush with the bottom of the probe shaft and place the product float near the middle of the probe shaft.
   c. Check the height reading on the tank gauge monitor (after allowing sufficient time for the monitor to respond).
   d. Measure the distance from the bottom of the probe to the bottom of the product float and compare it with the reading on the monitor.
3. To test the accuracy of the product sensor:
   a. Using the tank console monitor, take an initial fuel level reading.
   b. Dispense one gallon of product into a calibrated container.
   c. Using the tank console monitor, take a second fuel level reading.
   d. Verify that the change in tank volume is one gallon.
4. To test the accuracy of the water sensor:
   a. Remove probe from the tank.
   b. By hand, move the water float up the probe to a point higher than the high water alarm set point.
   c. The monitor should respond with a high water alarm report. (The water height may also appear on the tank monitor display console.
   d. Check this height against its actual location.
5. The high water level alarm should not be set so high that water ingress into the tank goes undetected for long periods of time.

Disclaimer: This checklist is not intended to tell the technician how to perform the maintenance and system check. Technicians should follow manufacturers' detailed instructions while making sure that all of the items on this checklist have been covered.

APPENDIX 41
Wisconsin ATG Leak Detection Quick Reference Table

~~Table can be printed and attached.~~

Note: Leak detection equipment installed in systems with greater than 10% ethanol should be free of zinc, lead, aluminum, tin or their alloys (brass, terne (lead-tin alloy)).

MA# Manufacturer	Model	TEST TYPE	Minimum Fill	Test Period	THRESHOLD	MAX. CAPACITY	COMMENT
20080005 (EECO System) OPW	SiteSentinel iSite--2 or 4 inch float--Probe 924B	0.2	50%	30 Min.	0.1	20,000	System automatically determines minimum time based on test conditions being met. Test times will be longer for larger tanks.
	SiteSentinel iSite----4 inch float----Probe 924B	0.1	95%	1.5 Hrs	0.05	20,000	
	SiteSentinel iSite----2 inch float----Probe 924B	0.1	95%	6.0 Hrs	0.05	20,000	
	SiteSentinel iSite-4 inch float-Probe Q0400-4XX	0.2	50%	4.0 Hrs	0.1	20,000	
20080009 (EECO System) OPW (Renewal for 20030003)	1500 & 2000	0.2	9%	3.3 Hrs	0.1	20,000	System automatically determines minimum time based on test conditions being met. Test times will be longer for larger tanks.
	Probe Q0400-4XX (Magnetostrictive)	0.1	95%	3.5 Hrs	0.05	20,000	
	EECO SLD	.2 Cont.	9%			2 Tank Max.	
	Probe Q0400-4XX (Magnetostrictive)					<=35K	SLD 130K Maximum Throughput
20080010 OPW (Revised 20030001)	PETROSONIC III Probe 613	0.2	59%	2 Hrs		15,000	
	SITE SENTINAL Probe 613	0.2	14%	2 Hrs		15,000	
	SITE SENTINEL I,II,III, iTouch Probe 924	0.2	50%	=		20,000	30 & 60 Minute Test
	SITE SENTINEL I,II,III, iTouch Probe 924	0.2	14%	=		20,000	2 & 3 Hour Test
	SITE SENTINEL I,II,III VTTT Probe 613	0.1	95%	=		15,000	2 & 3 Hour Test
	SITE SENTINEL I,II,III VTTT, iTouch Probe 924	0.1	95%	=		20,000	2 & 3 Hour Test
20060002 Franklin Fueling	INCON TS-5, 550, 750, 1000, 1001, 2001, 5000	0.2	See Below	5 1/4 Hrs	0.1		Test time is an average; actual times based on pre-set test condition criteria
	Probe: TSP-LL2	0.1	95%	5 3/4 Hrs	0.05	15,000	
	INCON TS-5, 550, 750, 1000, 1001, 2001, 5000 Probe: TSP-LL2	0.2 ONLY	See Below	<7 Hrs	0.1	30,000	Maximum 3 Manifolded Tanks
	TS-5, 550, 750, 1000, 1001, 2001, 5000 SCALD	0.2	15%	Continuous	0.1	49,336	Maximum Monthly Throughput of 304,620 gallons Will not test if below minimum.
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Required						
	24" 9" / 72" 15" / 120" 21"						
	36" 10.5" / 76" 15.5" / 126" 21.5"						
	48" 12" / 84" 16.5" / 132" 22"						2000 Scald See MA 96000037
	52" 12.5" / 96" 17.5" / 144" 23.5"						
	64" 14" / 108" 19"						
20050005 Veeder-Root Co. TLS, EMC Series Pro Plus, ProMax (Supercedes 20030004R1, 20030007) (Revised 2002005R1)	Probe 7842 (Capacitance) All Models Except TLS2	0.2	50%	5 Hrs	All probes have a preset threshold which cannot be changed. Pass or Fail	15,000	Note: Capacitance probes will not function properly when the ethanol content is above 10%.
	Probe 8472 (Capacitance)	0.1	95%	2 Hrs		15,000	
	All Models Except TLS250, TLS250i & TLS2	0.2	50%	2 Hrs			
	Probe 8463 & 8473 (Magnetostrictive)	0.1	95%	3 Hrs		15,000	
	TLS250iPlus,TLS300,TLS300i,TLS300iPlus,	0.2	See Below	2 Hrs			
	Probe 8463 & 8473	0.1	95%	2-5 Hrs		20000	
	TLS 350 Series, TLS2, ProMax, EMC except Basic	0.2	See Below	2 Hrs		30000	
	8463 and 8473 W/CSLD	.2 Cont.	5%			45000 single	28 Days 227,559 thru-put
	TLS300, TLS350, EMC Series, ProPlus, ProMax					37K manifolded	28 Day 226,848 thru-put
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Re						Checks fuel level. Will not test if below minimum requirement.
	24-26" 9" / 70-79" 24" / 123-133" 39"						
	27-36" 12" / 80-90" 27" / 134-143" 42"						
	37-47" 15" / 91-101" 30" / 144-154" 45"						
	48-58" 18" / 102-111" 33" / 155-165" 48"						
	56-69" 21" / 112-122" 36" / 166-175" 51"						

20050001 Southwest Envir. Srvs	US Test Model 2001	0.2	50%	30 Min.	0.1	15,000	Ultrasonic Probes
		0.1	95%	1 Hr.	0.05	15,000	
20040007 OMNTEC Mfg.	OEL8000II	0.2	See below	4.5 Hrs.	0.1	30,000	
	OEL8000II w/CITLDS	0.2	12.70%	Continuous	0.1	18,000	
	Minimum product level based on tank diameter:						
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Require						
	0-48" = 12" / 73-96" = 20" / 133 or greater = Contact OMNTEC						
	49-64" = 15" / 97-126" = 15.5"						
	65-72" = 16" / 127-132" = 26"						
20040006 Franklin Fueling Sys. (Revised 20020004) For EBW systems prior to March 1, 2004 see MA 20020004	AUTOSTIK II & JR	0.2	See below	5 1/4 Hrs	0.1	15,000	Test time is an average; actual times based on pre-set test condition criteria
	w/ Magnetostrictive Probe	0.1	95%	5 3/4 Hrs	0.05	15,000	
	AUTOSTIK II & JR w/ TSP-LL2 series probe	0.2	See below	< 7 hrs.	0.1	30,000	
	AUTOSTIK II & JR w/ SCALD 2.0	0.2	14%	Continuous	0.1	49,336	Throughput Restrictions/2 max. manifolded
	Minimum product level based on tank diameter:						
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Require						
	26" = 9" / 72" = 15" / 120" = 21"						
	36" = 10.5" / 76" = 15.5" / 126" = 21.5"						
	48" = 12" / 84" = 16.5" / 132" = 22"						
	52" = 12.5" / 96" = 17.5" / 144" = 23.5"						
	64" = 14" / 108" = 19"						
20030008 Caldwell Systems Corp.	Tank Manager ATG System	0.2	18 in.	3 Hrs, 15 min.		20,000	Ultrasonic probe
		0.1	95%	3 Hrs, 15 min.		20,000	Ultrasonic probe
20030007 Veeder-Root Co. Red Jacket Pro Plus & ProMax	Probe 7842 (Capacitance) w/ ProPlus & Pro	0.2	50%	5 hrs	All probes have a preset threshold which cannot be changed by operator. Pass or Fail Only	15000	
	Probe 8472 (Capacitance) w/ ProPlus & Pro	0.2	50%	2 Hrs			
		0.1	95%	2 Hrs			
	Probe 8463 & 8473 (Magnetostrictive)w/ ProPlus	0.2	see below	2 hrs			
		0.1	95%	3 Hrs			
	Probe 8463 & 8473 (Magnetostrictive) w/ProMax	0.2	see below	2 Hrs		30000	
		0.1	95%	2-5 Hrs		20000	
	Probe 8463 & 8473 (Magnetostrictive) w/CSLD	0.2	5%			45000 single	Throughput Restrictions
	Minimum product level based on tank diameter:						
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Require						
	24-26" 9" / 70-79" 24" / 123-133" 39"						
	27-36" 12" / 80-90" 27" / 134-143" 42"						
	37-47" 15" / 91-101" 30" / 144-154" 45"						
	48-58" 18" / 102-111" 33" / 155-165" 48"						
	59-69" 21" / 112-122" 36" / 166-175" 51"						

Formatted: Font: (Default) NJDFPJ+TimesNewRoman, 12 pt, Bold, Font color: Red

Formatted: Font: (Default) NJDFPJ+TimesNewRoman, 12 pt, Bold, Font color: Red

20030004R1 Veeder-Root Co. TLS Series (Supersedes 20030004)	Probe 7842 (Capacitance) All Models Except TLS2	0.2	50%	5 Hrs	All probes have a preset threshold which cannot be changed. Pass or Fail	15,000	Note: Capacitance probes will not function properly when the ethanol content is above 10%.
	Probe 8472 (Capacitance) All Models Except TLS250, TLS250i & TLS2	0.1 0.2	95% 50%	2 Hrs 2 Hrs		15,000	
	Probe 8463 & 8473 (Magnetostrictive) LS250iPlus,TLS300,TLS300i,TLS300iPlus,TLS300	0.1 0.2	95% See Below	3 Hrs 2 Hrs		15,000	
	Probe 8463 & 8473 TLS 350 Series & TLS2	0.1 0.2	95% See Below	2-5 Hrs 2 Hrs		20000 30000	
	8463 or 8473 W/CSLD TLS300 & TLS350 Series	.2 Cont.	5%			45000 single 37K manifolded	28 Days 227,559 thru-put 28 Day 226,848 thru-put
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Re						Checks fuel level. Will not test if below minimum requirement.
	24-26" 9" / 70-79" 24" / 123-133" 39"						
	27-36" 12" / 80-90" 27" / 134-143" 42"						
	37-47" 15" / 91-101" 30" / 144-154" 45"						
	48-58" 18" / 102-111" 33" / 155-165" 48"						
	56-69" 21" / 112-122" 36" / 166-175" 51"						
20020005R1 GILBARCO, INC.	TM-2, TM-3, EMC Probe PA0238 (Capacitance)	0.2 ONLY	50%	5 Hrs	All probes have a preset threshold which cannot be changed. Pass or Fail	15,000	
	TM-2, TM-3, EMC PROBE PA0264 (Capacitance)	0.2 0.1	50% 95%	2 Hrs 2 Hrs		15,000 15,000	
	TM-2, TM-3 Probes PA0265 & PA0300 (Magnetostrictive)	0.2 0.1	See Below 95%	2 Hrs 3 Hrs		15,000 15,000	
	EMC Probes PA0265, PA0300 (Magnetostritive)	0.2 0.1	See Below 95%	2 Hrs 2-5 Hrs		20,000	
	EMC W/CSLD Probes PA0265, PA0300 (Magnetostrictive)	.2 Cont.	5%	na	Will not test below minimun	45K, 37K Mani-fold Aggregate	Throughput 227,559 single 226,848 Aggregate
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Re						
	24"- 26" 9" / 70"- 79" 24" / 123"- 133" 39"						
	27"- 36" 12" / 80"-90" 27" / 134"- 143" 42"						
	37"- 47" 15" / 91"- 101" 30" / 144"- 154" 45"						
	48"- 58" 18" / 102"- 111" 33" / 155"- 165" 48"						
	59"- 69" 21" / 112"- 122" 36" / 166"- 175" 51"						
20020004 EBW, Inc.	AUTOSTIK II & JR w/ 960/961 Series Probes	0.2 0.1	50% 95%	4 hrs 4 hrs	0.1 0.05	15,000 15,000	Testing can be performed on one tank at a time.
	AUTOSTIK II & JR CSLD v31 or v51	0.2	30%		0.07	30,000	<150K Monthly thru-put
	NOTE: EBW 970 & 973 series probes are for inventory measurements only, not for leak detection. SEE 990053 for AUTOSTIK						Testing can be performed on one tank at a time.
990053 EBW, Inc.	Autostik (950 series) ONLY	0.2 0.1	10% 95%	4 hrs 4 hrs	0.1 0.05	15,000 15,000	
	SEE 20020004 for Autostik II & Jr						
20010019 Emco Electronics	EECO TLM 1000, 3000	0.2 0.1	14% 95%		0.1 0.05	20,000 20,000	See 20030003 for EECO 1500,2000,SLD

Formatted: Font: (Default) NJDFPJ+TimesNewRoman, 12 pt, Bold, Font color: Red